

**DEFINING  
TAMPER-PROOF, LONG-LIFE, BATTERY OPERATED, HUSH-FEATURED  
SMOKE ALARMS**

EXECUTIVE DEVELOPMENT COURSE, NFA

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## **ABSTRACT**

This research project analyzed issues surrounding the adoption of smoke alarm standards that require a sealed exterior case, a hush button and a long-life (10 year) integrated battery.

The problem was that there was no standard definition of a tamper-proof, long-life, battery operated, hush featured, smoke alarm in the State of Oregon. The purpose of the project was to create a functional definition of a tamper-proof, long-life, battery operated, hush featured, smoke alarm.

This research project employed the action research methodology to identify (a) what current national definitions exist for tamper-proof, long-life, battery operated, hush featured, smoke alarms, (b) what human behaviors is the tamper-proof, long-life, battery operated, hush featured, smoke alarm designed to thwart and (c) what tamper-proof features have been proved effective.

To effect the action research methodology, a review of the current status was conducted which considered what causal and contributing factors existed.

The results reflected that (a) there is no current national standard for a tamper-proof, long-life, battery operated, hush featured, smoke alarm in the nation, (b) the described features would likely thwart the human behaviors that render smoke alarms inoperable, (c) no body of research has been completed or compiled on the value of the individual proposed features on reducing behaviors that lead to disabling smoke alarms.

The recommendations, as a result of this research, are (a) a national standard definition of the described smoke alarm should be adopted as an industry standard, (b) the adoption of a standard should be supplemented by a public education campaign and (c) that a quantitative study should be conducted on the individual value of each of the primary smoke alarm features...sealed case, hush button and a long life battery.

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## INTRODUCTION

To reduce fire deaths in residential dwellings, the State of Oregon has adopted laws which require the sale of only tamper-proof, long-life, battery operated, hush featured smoke alarms. Oregon fire officials believe that the requirement to install smoke alarms which are difficult to disable will result in fewer fire deaths and injuries.

The problem is that there is no standard definition of a tamper-proof, long-life, battery operated, hush featured smoke alarm in the State of Oregon.

The purpose of this research paper is to create a functional definition for a tamper-proof, long-life, battery operated, hush featured smoke alarm.

The action research methodology will be employed to answer the following questions:

1. What current national definitions exist for a tamper-proof, long-life, battery operated, hush featured smoke alarm?
2. What human behaviors is the tamper-proof, long-life, battery operated, hush featured smoke alarm designed to thwart?
3. What tamper-proof features have been demonstrated as effective?

## **BACKGROUND AND SIGNIFICANCE**

Like most problems, fire problems are transient and largely dependent on external factors. In the mid 1980s, less than 5 percent of homes had at least one smoke alarm (Goldstein, 1999). The historical fire prevention emphasis associated with smoke alarms was aimed at causing smoke alarms to be installed in residential dwelling units.

Today, according to Robert Miller, Western Regional Manager for National Fire Protection Association, 93 percent of American homes have at least one smoke alarm (personal communication, October 16, 1998).

In the United States the fire death problem remains in the home. According to Carrye Brown, United States Fire Administration Administrator, “The majority of civilian fire deaths (74 percent) continue to occur in residences even though residences only have 23 percent of the fires” (“USFA Begins new study,” 1999).

While historically people lacked the mechanisms to alert them to the presence of fire, today those mechanisms are available but are often not in working order.

Although fires in residential occupancies only account for 23 percent of all fires, they account for 83 percent of all fire deaths (Goldstein, 1999). Fire deaths are more likely to occur if the occupants don’t have sufficient warning to the presence of a hostile fire. The presence of a smoke alarm is of little consequence if it is not functioning properly.

Approximately 20 percent of all alarms currently installed in homes do not work (Wolf, 1999). While the reasons for inoperable smoke alarms are many, 60 percent of alarms have been rendered inoperable by the occupants disconnecting the power supply (Wolf, 1999).

Hard-wired smoke alarms account for only 1 percent of the statistics for alarms disabled by power disconnect (Ahrens, 1998), which places the emphasis squarely on the battery-operated smoke alarm.

Because the majority of homes (72 percent) have battery operated smoke alarms (Smith et al., 1997), understanding the human component of why alarms are disabled is critical to finding a solution.

When 72 percent of residences are equipped with battery operated smoke alarms, 20 percent of which are not operable, and 60 percent of those are rendered inoperable by the occupant, measures should be taken to minimize inoperativeness.

Occupants typically disable smoke alarms due to nuisance alarms (Ahrens, 1998). Of the total disabled alarms, 55 percent are disabled by removing the battery to either eliminate false activations or eliminate the chirp from the low battery warning (Ahrens, 1998). More than one third of the remaining alarms have dead or disconnected batteries from negligence or nuisance elimination or people who forgot to replace the batteries (Smith et al., 1997).

Because disabling or neglecting to replace a depleted power supply and nuisance activations account for 95 percent of all disabled alarms (Ahrens, 1998), actions are necessary to reduce these two primary contributing factors.

Developing a smoke alarm definition that includes a 10 year power supply, a hush feature and a sealed exterior case is the first step toward broad acceptance of the concept. Further, an alarm manufactured and installed to this standard should prove a substantial contribution to reducing the number of inoperable smoke alarms.

In theory, the 10-year battery will eliminate the need to replace the batteries until the alarm has completed its useful life as an electronic component. The integrated wiring of the battery

into the circuit would reduce the possibility that someone may attempt to remove it or seek alternative uses of the battery. By designing an alarm with a hush feature, the occupant will have the choice of simply pressing a button to quiet a nuisance alarm, contrasted with prying open a sealed unit to silence the device.

The logical prediction is that, the occupant will choose the simplest and easiest of the two alternatives and simply press a button. Finally, by sealing the alarm's case, substantial effort is required to render the device inoperable, thus deterring one so motivated.

While the perspectives of manufacturers, wholesalers, designers, retailers, regulators, code-promulgators and fire officials vary drastically, it is the responsibility of fire service leaders to do the ethical thing and seek a solution to a very clear problem.

Coupled with an increasing trend toward disabling smoke alarms, Tualatin Valley Fire & Rescue experienced the nation's worst fire disaster in 1997, therefore this definition is fundamental to the establishment of a state-wide standard that can be implemented locally.

A definition for a tamper-proof, long-life, battery operated, hush featured smoke alarm is the next step in advancing residential fire safety.

## LITERATURE REVIEW

Pat Coughlin, EFO, Director for Operation Life Safety (personal communication, August 28, 1999), noted that “there is no national definition for a tamper-proof, long-life, battery operated, hush featured smoke alarm”. According to Mr. Coughlin (personal communication, August 28, 1999), “Oregon is the only state that is currently attempting to define one although New York and New Jersey are watching the developments closely”.

H. Wayne Boyd, WS Safety and Engineering was commenting on the Oregon legislation (Wolf, 1999) by stating that “it’s a unique law that doesn’t lend itself to the product they’re trying to require...there isn’t any standard for a 10-year battery in smoke alarms”

While the requirement for residential smoke alarms in 44 of the 50 states (Goldstein, 1999) seems to create a clear consensus as to their value, none of the current nationally accepted standards including National Fire Protection Association, define a tamper-proof, long-life, battery operated, hush featured smoke alarm (NFPA Handbook, 1997).

In Oregon, the 1999 Legislature redefined a smoke alarm under Oregon Revised Statute 479.250, to include a long-life battery, hush feature and tamper-resistant cover. By mandating a less accessible battery and providing a silencing button, this legislation was aimed at reducing the number of people who would disable their smoke alarm (Oregon H.R. 2586, 1999).

Unfortunately, the Oregon effort fell short of effectively defining a tamper-proof, long-life, battery operated, hush featured smoke alarm due to pressure from manufacturers and designers (Legislative minutes, Oct. 20, 1998). Manufacturers expressed their discomfort with existing inventory levels, limited battery manufacturers and patent rights which are held on some of the specific features.

Even though the primary emphasis of operational smoke alarms is to alert occupants to the presence of fire, there are other benefits of early detection. Fires that are detected in the incipient phase are easier to extinguish than fires that reach the free burning phase. Firefighters will typically be at greater risk when fighting a large fire than a fire in an incipient phase. Even with all of the advancements, still approximately 100 firefighters die in the line of duty each year (Carrell, 1999). Earlier detection on a broad scale should lower inherent risks for occupants and firefighters alike.

In a 1995 study, the Consumer Products Safety Commission learned that 20 percent of all residential smoke alarms don't sound during a fire. The research also indicated that 60 percent of the non-working alarms had power-sources that were disconnected (Wolf, 1999).

Pat Coughlin, Director for Operation Life Safety stated "the biggest reason people disable their smoke alarms is because of cooking and we already have a reasonable solution to this problem...photoelectric alarms" (Wolf, 1999).

Photoelectric (optical) smoke alarms are 10-20 percent less likely than ionization alarms to activate to cooking odors (Marriott, 1995).

The disadvantage of ionization alarms lies in their elevated reaction to cooking odors and steam, generating nuisance alarms (Marriott, 1995). Their advantages are that they can operate on battery power for 10 years or possibly longer. Specifically, one manufacturer currently carries an Underwriters Listing for such a product (Wolf, 1999). Photoelectric alarms have power requirements that make this impractical.

While photoelectric alarms are less susceptible to nuisance alarms, they account for only 28 percent of the total installed alarms and their power demands make a 10-year battery technically unattainable (Ahrens, 1998). In fact, 81 percent of homes with smoke alarms built prior to 1980

have battery operated smoke alarms (Ahrens, 1998). This coupled with the conclusions of the US Fire Administration study of Socioeconomic Factors and the Incidence of Fire that most fires and fire fatalities will occur in older occupancies to victims of lower socioeconomic means (TriData, 1997).

Smoke alarm degradation will continue to be a growing problem. In the mid 1980s, fewer than 5 percent of American homes had smoke alarms...now 93 percent of homes have a least 1 alarm (Goldstein, 1999)

Jim Crawford, Fire Marshal for Portland, Oregon states that “the fire service should be looking for an alarm with low maintenance and tamper-proof as possible and with a 10-year battery there is less chance of it being inoperable” (Wolf, 1999). In Mr. Crawford’s opinion, “the worst that could happen is that the battery won’t last 10 years and then you have a warranty issue rather than a safety issue” (Wolf, 1999).

According to the national Institute of Standards and Technology’s Dick Bukowski, who is also the Chairman of the Household Fire Warning Equipment Committee, he states that “Smoke alarms should only be used for 10 years” (Wolf, 1999).

The proposed version of National Fire Protection Association standard 72, appears to agree with Mr. Bukowski by stating that “smoke alarms should be replaced every 10 years” (Wolf, 1999).

Marty Ahrens, a Fire Analysis Researcher with National Fire Protection Association, has studied the US experience with smoke alarms. Mr. Ahrens concludes, “when alarms don’t work, it is usually because batteries are dead, disconnected or missing” (Ahrens, 1998). This is generally due to nuisance activation or failure to check the battery every year. Ahrens further

identifies that 20 percent of all alarms are inoperable due to disconnected power sources at the hands of the occupants.

While it seems obvious, virtually 100 percent of power source disconnects come from human intervention or lack of intervention (Ahrens, 1998). 95 percent of these failures occur with battery operated smoke alarms, as hard-wire disconnection only accounts for 5 percent of the total disconnects. Further, Mr. Ahrens recognized that disconnection for nuisances is eight times as frequent as battery removal for other uses.

Mr. Ahren's research found that the causes of nuisance alarms are evenly distributed between cooking activation and silencing the low-battery alert engineered into the product. In addition, false activations have also begun to desensitize occupants. Subjects interviewed, demonstrate that only 7 percent of those, thought there might be a fire during an alarm activation. Additionally, 22 percent of people, who experienced nuisance alarms, react by disabling the smoke alarm (Americans don't understand, 1997)

In a letter from National Fire Protection Association Western Regional Manager, Robert Miller to Oregon Fire Marshal Chief Deputy Bob Garrison, Mr. Miller reaffirms much of the prior research. Mr. Miller recognizes that occupants disconnecting the power supply is the primary cause of inoperativeness. The process of rendering the alarm inoperable is largely in response to nuisance alarms caused by improper installation and cooking odors or shower steam (personal communication, October 16, 1998).

In summary, the reviewed literature reflects both the mass penetration of smoke alarms in residential occupancies and that most of which are battery operated alarms. While nearly every home has a smoke alarm, the occupants have rendered approximately 20 percent of those alarms inoperable.

Nuisance alarms that result from cooking and low-battery warnings account evenly for the majority of causation as to why occupants disable their smoke alarms. A tamper-proof, long-life, battery operated, hush featured smoke alarm could potentially be effective in discouraging the disabling of smoke alarms.

People disable their smoke alarms to thwart alarm activation from cooking odors, steam and to silence persistent low-battery warnings. While photoelectric smoke alarms are 10-20 percent less susceptible to false activation, they have power requirements that essentially require the unit to be hard-wired or require more frequent battery changes than ionization alarms.

By designing a smoke alarm to thwart disabling actions, while providing a silencing feature that is easier than permanently rendering the alarm inoperable, there is a reasonable possibility of that such a unit will prove effective.

## **PROCEDURES**

### **Definitions**

**Smoke Alarm:** A self-contained single or multiple station detection device for the products of combustion other than heat. Which when triggered, causes an alert to sound or flash.

**Battery Operated:** A smoke alarm that operates under the sole power supply of installed batteries.

**Integrated Battery:** A battery power supply that is permanently wired into the circuitry that cannot be removed without special tools and substantial effort.

**Ionization Alarm:** An alarm that is activated by radioactive material ionizing smoke particles which causes electrical current fluctuations thus activating the alarm.

**Photoelectric Alarm:** An alarm that is activated by a light beam becoming scattered by smoke particles. The smoke alarm is thus activated when the light intensity decreases due to the scattering effect and the circuitry recognizes such a deviance from an engineered standard.

**Tamper-Proof:** The sealed exterior case of the smoke alarm, once installed cannot be opened without special tools and knowledge, and would require substantial effort which would likely result in the destruction of the exterior case.

**Hush Featured:** A clearly visible button on the exterior of the smoke alarm case allowing for nuisance alarms to be silenced for a period of 4-6 minutes by a single depression. This feature shall require no special knowledge, skills or tools to operate effectively.

**Long-Life Battery:** An integrated battery or combination of batteries that are certified and warranted to provide a continuous power supply to the smoke alarm for a period of at least ten years.

**Low Battery Warning:** An audible warning or alert that notifies the occupant that battery life is about to expire and the unit needs to be replaced.

**Tamper-Proof, Long-Life, Battery Operated, Hush Featured, Smoke Alarm:** Incorporates all of the previous defined terms into a single smoke alarm unit.

**Underwriters Laboratory:** This term shall be inclusive of Underwriters Laboratory specifically and also include any other Nationally recognized testing laboratory which is approved to certify such devices.

For this research paper, the action research methodology was selected because it provides for an effective review of available current information and also yields a working definition for a tamper-proof, long-life, battery operated, hush featured, smoke alarm.

There is no current standard definition of a tamper-proof, long-life, battery operated, hush featured, smoke alarm.

The research procedure used in preparing this paper began with a literature review of the materials available in the Learning Resource Center at the National Emergency Training Center as of August 1999. Additional materials were collected from the Oregon Legislature Records Center and minutes from hearings and meetings related to the adoption of new smoke alarm legislation in Oregon.

Due to limited published information on such an emerging technology, written material was supplemented by interviews with leaders in the smoke alarm and fire prevention community.

The problem is that there is no standard definition of a tamper-proof, long-life, battery operated, hush featured, smoke alarm in the State of Oregon. Additionally, there is no current definition for such a device nationally. This is possibly due to the emerging nature of the technology and that, smoke alarm problems have shifted from an emphasis on installation, to limiting the intentional disabling or failure to maintain the units.

The purpose of this research paper is to create a functional definition for a tamper-proof, long-life, battery operated, hush featured, smoke alarm. By creating a definition addressing the shortcomings of current units, manufacturers and code promulgators can standardize their approach to non-functioning and disabled smoke alarms.

Procedurally, the findings of the literature review were evaluated for the causal factors and compared to the situational forces. Casual contributing factors were eliminated through this process which helped chart topical priorities.

The problems have been caused by an uncoordinated approach to reducing the number of disabled and inoperable smoke alarms. Manufacturers who are trying to meet marketing

challenges, price points, remain price competitive and honor patented technologies are often at the mercy of the battery manufacturers.

Code promulgators, who have the responsibility of designing solutions to address fire and life safety deficiencies are often influenced by manufacturers, retailers and their respective associations while also facing a lack of available research on demonstrated solutions.

The evidence seems compelling that technology has evolved to a point where solutions to historical problems are now available. The situational and statistical impetus is compelling the industry to capitalize on battery and circuit improvements as potential solutions to problems.

Existing forces that are likely to impede the process include an inherent resistance to change, coupled with corporate concerns. Manufacturers are justifiably concerned about the competitiveness of their current product lines. Further, they fear a mandate which could potentially require them to purchase patented technologies from competitors.

By capitalizing on the driving forces, gathering support from manufacturers currently manufacturing smoke alarms, code promulgators will likely be forced to take action.

By adopting a standardized smoke alarm definition, individual states will force manufacturers to choose between the loss of market share or creating a product to meet the new standard. Because, market share is a primary driving force in industry, it will be a compelling component in their decision making process.

## RESULTS

### **1. What current national definitions exist for tamper-proof, long-life, battery operated, hush featured, smoke alarms?**

The literature review failed to reveal any current standard definitions for a tamper-proof, long-life, battery operated, hush featured, smoke alarm anywhere in the Nation. Pat Coughlin, Director of Operation Life Safety, confirmed this fact in a recent interview on the matter (personal communication August 28, 1999). A complete review of National Fire Protection Association standards and the literature in the Learning Resource Center, failed to uncover any existing standards for a tamper-proof, long-life, battery operated, hush featured, smoke alarm.

Mr. H. Wayne Boyd from WS Safety and Engineering (Wolf, 1999) reaffirmed that there is no standard for a 10-year battery operated smoke alarm.

Results of the research reflect that there is no current national standard for a tamper-proof, long-life, battery operated, hush featured, smoke alarm in the nation.

### **2. What human behaviors is the tamper-proof, long-life, battery operated, hush featured, smoke alarm designed to thwart?**

The literature review showed that the combination of the described features is key to the unit's success. As such, the combined features of the unit minimize the potential that the user will disable the smoke alarm. The tamper-proof case is intended to make opening the smoke alarm difficult or nearly impossible. The literature review revealed that the smoke alarms are typically disabled only after the case is opened to disconnect the power supply in an effort to quell nuisance alarms or disable low-power warning features.

The presence of a clearly visible hush-button that will silence the smoke alarm is an easier solution than the alternative of prying open a sealed case. It seems logical that a user would choose the easier of the two options to silence an alerting smoke alarm.

Of the total smoke alarms disabled due to power disconnect, 5 percent are hard-wired to electrical circuits (Ahrens, 1998). While hard-wired smoke alarms are typically photoelectric due to their power requirements, photoelectric smoke alarms are only 10-20 percent less likely to falsely alert. A reliable power supply whether battery or hard-wired, contributes to the smoke alarm remaining functional.

The installation of a 10-year battery eliminates a majority of those alarms that are inoperable due to a dead battery, battery removed to eliminate the low battery warning and the battery being removed for other uses (Ahrens, 1998).

Incidentally, replacing the unit every 10 years would also reduce the number of alarms that fail due to the age of the unit. According to the Chairman of the Household Fire Warning Equipment committee and the proposed National Fire Protection Association 72, smoke alarms should be replaced at 10 years. These two factors combine to make the battery package and the natural replacement cycle of the unit congruent.

The result of the research indicates, that the features afforded by a tamper-proof, long-life, battery operated, hush featured, smoke alarm would likely thwart behaviors which render smoke alarms inoperable.

### **3. What tamper-proof features have been demonstrated effective?**

A complete review of the cited literature did not reveal any objective studies that clearly demonstrate the features of a tamper-proof, long-life, battery operated, hush featured, smoke alarm to have been effective.

Rather, the features appear to address/thwart known human behaviors, which render smoke alarms inoperable. Although the conclusions seem inferential, they are a logical extension of the facts, which the literature review identified.

The research demonstrated an uncoordinated approach to thwarting the human behaviors that lead to inoperable smoke alarms. Specific manufacturers have concerns that are unique to them. Some manufactures oppose creating such a standard because it may force them to purchase patented technology or render their current product-mix instantly non-saleable.

Still, other manufactures welcome a new standard because their product line is prepared for the emerging market thus they are looking to increase market share. These concerns are not unique to the manufactures of smoke alarms. The manufactures of the battery technologies have the same concerns and opportunities.

Further, the research demonstrated that 95 percent of inoperable smoke alarms have been disabled by the users/occupants who disable the alarms almost exclusively due to nuisance alarms caused by false activation or low-battery alerts.

Finally, the research seemed to draw a correlation between power supply stability and the long-term operability of the smoke alarm.

The features that would most likely reduce the inoperativeness rate of smoke alarms would include a permanently installed/integrated battery with a 10-year life, which is activated only upon installation, a unit and battery system that is UL listed, a sensor that is either photoelectric or ionization type, a sealed case, a hush-button that will silence the smoke alarm for 4-6 minutes and a low-battery warning that signals the end of the unit's useful life (Appendix A).

It was an unexpected finding to learn that there have been no objective tests conducted to measure the effectiveness of specific features that would reduce the inoperativeness rate for smoke alarms.

## **DISCUSSION**

Attempts by fire officials in the State of Oregon to adopt a standard for a tamper-proof, long-life, battery operated, hush featured, smoke alarm have drawn attention to a divisive issue that has yet to be adequately addressed by the safety community.

Pat Coughlin, Director for Operation Life Safety notes (personal communication, August 28, 1999) that there is no current definition for a tamper-proof, long-life, battery operated, hush featured, smoke alarm, however Operation Life Safety is not currently attempting to define one either.

While Oregon struggles to define a tamper-proof, long-life, battery operated, hush featured, smoke alarm, other states watch and wait as they also consider ways to solve the inoperativeness problem.

The industry agrees, however that there is a problem with battery operated smoke alarms and their power supplies. The Consumer Products Safety Commission learned in a 1995 study that 20 percent of all residential smoke alarms don't sound during a fire (Wolf, 1999). This same research indicated that 95 percent of the smoke alarms were inoperable due to a disconnected or nonfunctional power supply. The remaining 5 percent of inoperable alarms were hard-wired.

Additionally, National Fire Protection Association Regional Manager Robert Miller, in a letter to the Oregon State Fire Marshal (Letter dated October 16, 1998), acknowledged that "the

primary cause of alarm inoperativeness was due to the occupant disconnecting the power supply”.

Operation Life Safety suggests that the solution to disabled battery power supplies is to install hard-wired photoelectric smoke alarms (Wolf, 1999). While this suggestion is logical for new construction, it is unlikely that existing property owners will rewire their properties to accommodate a hard-wired smoke alarm. In fact, 81 percent of all homes built prior to 1980 have battery operated smoke alarms (Ahrens, 1998).

Statistics suggest that a stable power supply contributes increases the number of operable smoke alarm (Ahrens, 1995). It seems reasonable, that if the low battery alert only occurs once in the life of the alarm (once in 10-years), rather than once every year, for 10 years, there is a substantial reduction in the likelihood that the occupant will disconnect the battery or let the battery expire completely.

The Oregon Legislature agreed with the long-battery life philosophy in 1999 when they adopted Oregon Revised Statute 479.250 requiring a 10-year battery for all battery operated smoke alarms sold or installed in Oregon (Oregon H.R. 2586, 1998).

Jim Crawford, Fire Marshal for Portland, Oregon, states “the fire service should be looking for an alarm with low maintenance that is as tamper-proof as possible and has a 10-year battery” (Wolf, 1999).

Chief Crawford accurately reasons that with a low-battery power warning as a required feature, the 10-year battery can only enhance safety. Further, in the event of a battery failing to live 10-years, it becomes a warranty issue rather than a life safety issue (Wolf, 1999).

While the cost of the added features is a consideration raised by the manufactures, Oregon Senator Randy Leonard (Legislative meeting notes, October 20, 1998) correctly points

out, that "the cost of replacing batteries each year for 10 years must exceed any additional cost of the 10-year smoke alarm and the additional features" (Wolf, 1999).

Advocates for the 10-year power supply are growing. National Fire Protection Association 72, as proposed and now awaiting ratification, will require 10-year batteries in all battery operated smoke alarms. In his October 1998 letter to the Oregon State Fire Marshal, Mr. Miller of National Fire Protection Association states "existing construction would benefit from 10-year lithium battery powered smoke alarms".

Apparently, Mr. Jim Hoebel, Chief Engineer for the Fire Hazards Unit of the Consumer Products Safety Commission agrees, stating, "the 10 year battery technology is taking smoke alarm technology in a productive direction" (Wolf, 1999) .

Additionally, the Consumer Products Safety Commission recently announced a joint effort between their organization and the Center for Disease Control, which would create a 10-year smoke alarm give-away program (Wolf, 1999).

While the 10-year battery is an important component, to maximize our attempts to change human behaviors, we must address the issue of nuisance alarms.

Research shows (Wolf, 1999) that the cause of nuisance alarms is nearly evenly split between cooking odors and deactivating the alarm to quell the low-battery warnings. While the 10 year battery addresses the frequency of low battery warnings to once in a 10-year period, it does not address nuisance alarms from cooking.

Because we have established that 72 percent of all installed smoke alarms (Ahrens, 1998) are battery operated, it would not be logical to mandate hard-wired alarms to replace them. Rather, we should provide a battery operated alarm with a long and stable power supply for those situations.

While ionization (battery) alarms are between 10 percent-20 percent more prone to false activations than photoelectric alarms, National Fire Protection Association estimates that nuisance alarms could be reduced by 33 percent by properly locating the alarm away from cooking areas (Ahrens, 1998).

The purpose of the hush feature is to provide the occupant an option of disassembling a rather difficult case or pushing the button to silence nuisance activation. Logically, it is fair to assume people will choose the easier alternative of pushing the hush button.

The International Association of Fire Chiefs has concluded that 22 percent of people who experience nuisance activation will react by disabling the alarm (Americans Don't Understand, 1997).

There are however, concerns, Ric Erdheim, Senior Manager for the National Electrical Manufacturers Association commented in the February, 1999 edition of the National Fire Protection Association Journal states that "a hush button can be deadly in the wrong hands...especially for people with impaired judgement"

The value of the sealed case coincides well with the recommendation that smoke alarms be discarded after a 10 year life. Both National Fire Protection Association in the proposed standard 72, and the Fire Analysis and Research Division, (Experience with alarms, 1998) conclude that 50 percent of smoke alarms were inoperable when they were more than 10 years old.

If a sealed case, which deters tampering with the power supply, is coupled with a hush button, which allows a simple method to silencing nuisance activations are placed into a smoke alarm unit that will last its natural life of 10 years without maintenance, it appears that there is a high probability the combination will be effective.

This writer concludes that developing a standard definition for a tamper-proof, long-life, battery operated, hush featured, smoke alarm will further advance fire safety in dwelling units.

If Oregon adopts the complete standard, only battery operated smoke alarms that meet those criteria will be sold in the state, eventually leading to a conversion of all battery operated smoke alarms to the new standard. Because Oregon already requires the installation of hard-wired photoelectric smoke alarms in new construction, the new standard would apply to the 72 percent of existing homes that don't have hard-wired alarms.

Tualatin Valley Fire & Rescue has been providing and installing free smoke alarms equipped with tamper-proof, long-life, battery operated, hush features since 1996 in an effort to address the tampering problem. Without the adoption of a definition as described and then a requirement for the sale and installation, alarms not meeting this standard will continue to dilute our efforts.

Adoption of a standard that all Oregon retailers must follow would substantially enhance the operability of smoke alarms in our community. It would also have the corollary effect of reducing the amount of energy spent on replacing batteries annually by firefighters and occupants.

## **RECOMMENDATIONS**

- 1. A national standard definition of a tamper-proof, long-life, battery operated, hush featured, smoke alarm should be adopted (see appendix A) and become the industry standard for battery operated smoke alarms.**

While there are manufacturing standards in place for smoke alarms, there are no national standards that require a tamper-proof case, define a long-life battery as being a battery as lasting at least 10 years and define and require a hush button on all battery operated smoke alarms.

States and code promulgating agencies should adopt and incorporate Appendix A as the standard definition of a long-life, battery operated, tamper proof, hush featured smoke alarm.

Further, the individual states should adopt the standard definition and require that only hard-wired photoelectric or smoke alarms meeting the adopted standard could be installed or sold within the state.

**2. In addition to mandating a smoke alarm which reduces the likelihood that occupants/owners will disable the smoke alarm, an aggressive public education campaign that outlines the perils of disabling a smoke alarm is recommended.**

It would be shortsighted to simply focus on the mechanical components enabling the inoperativeness of smoke alarms. Rather, an effective mass media education campaign extolling the virtues of the new type of alarm, and warning of the dire results of disabling any smoke alarm, should have a measurable impact on the statistics.

**3. Due to the absence of objective data regarding the demonstrated effectiveness of individual smoke alarm features as discussed, a quantitative study be conducted on the individual value of each of the primary smoke alarm features...sealed case, hush button and a long life battery is recommended.**

Although there is adequate data to provide for a statistical basis point for future studies, the features being discussed are so new to the industry that there has yet to be a study conducted as to their individual effectiveness.

While adequate, anecdotal information exists to draw logical conclusions and formulate hypotheses, it is yet to be statistically validated and tested.

A prerequisite to testing and actual field validation of the unit however, is the development of a functional definition for a tamper-proof, long-life, battery operated, hush featured, smoke alarm (appendix A).

Future readers should review statistics and experiences from states like Oregon, that have requirements that either completely or in part, meet the standard definition of a tamper-proof, long-life, battery operated, hush featured, smoke alarm. The experiences in Oregon should substantially contribute to the body of knowledge in this arena.

Lastly, consideration should be given to studying the actual battery life of units that are sold or marketed as having a 10-year battery life. This study should invalidate or validate the longevity claims of the manufacturers.

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## **APPENDIX A**

### **Definition of a Tamper Proof, Long-Life, Battery Operated, Hush Featured, Smoke Alarm**

Battery operated smoke alarms shall contain the following features to be legally sold or installed in the State of Oregon.

#### **Long-Life Features**

The battery or batteries shall be:

- Permanently installed as an integrated portion of the circuit with an engineered and warranted life of at least 10-years.
- The unit shall be listed by Underwriters Laboratory or other nationally recognized testing laboratory for overall design and battery life.
- Electronically isolated from the circuit until the installation of the unit.

#### **Tamper Proof Features**

The installed battery or batteries must:

- Be permanently wired as an integral part of the electronic circuit.
- Not be removable without substantial mechanical force and specialized knowledge or skills.
- Be protected by a case which seals or locks closed upon installation of the smoke alarm.

The exterior case of the smoke alarm must:

- Allow for installation of the smoke alarm with supplied fasteners to a flat surface.
- Once installed, the fasteners are not accessible without destruction of the exterior case of the smoke alarm.

- Be constructed from materials that withstand reasonable tampering without loss of structural integrity.
- Once installed, the unit shall seal the electronic components of the smoke alarm from tampering sans the destruction of the exterior case of the smoke alarm.

### **Hush Features**

The smoke alarm shall be designed and constructed with the following electronic features:

- Ionization smoke alarms must contain a clearly labeled and recognizable button, that is easily accessed by the user, and when pressed, causes the smoke alarm to be “silenced” for a period of 4 – 6 minutes.
- Ionization smoke alarms must automatically reset following a nuisance activation or having been silenced through the use of the hush button.
- Labeling for the hush feature shall include printed words on the case, in Spanish, English and a universal symbol depicting the function of the hush button all readable from a distance of 6 feet.

### **General Features**

- The unit shall be Underwriters Laboratory listed or listed with another Nationally recognized testing laboratory.
- The sensor shall be either an Ionization or Photoelectric type.
- The unit shall be designed and constructed in a manner that would require the replacement of the entire unit upon the end of the engineered/designed life of the smoke alarm.

- The unit shall be designed and constructed with a low-battery, progressive, chirp feature that audibly notifies the user that the unit needs to be replaced. The chirp shall increase in frequency and duration as battery life decreases and shall not be silenced by the hush button.